Claims

1. Method for manufacturing plate stacks, in particular for the production of coolers, cooler elements or heat sinks (6, 6a) made of at least one plate stack for cooling electric and/or opto-electric components, wherein the method consists of at least the following process steps:
   manufacture of plates or boards (1 – 5) of metal, for example copper,
   stacking of the plates to form a plate stack,
   joining of the plates (1 – 5) with the application of heat at a joining temperature (TF) and at an atmospheric pressure or in a vacuum,
   cooling of the plate stack formed by the joined plates to a temperature below the joining temperature (TF) and
   post-treatment (HIP treatment) of the plate stack in an inert gas atmosphere at an inert gas pressure (PB) between 200 and 2000 bar, for example between 400 and 2000 bar and at a post-treatment temperature (TB) that is below the joining temperature (TF).

2. Method according to claim 1, characterized in that the post-treatment temperature (TB) is approximately 95 to 99% of the joining temperature (TF).

3. Method according to claim 1 or 2, characterized in that the post-treatment temperature (TB) is at least 50% of the joining temperature (TF).

4. Method according to one of the foregoing claims, characterized by post-treatment of the plate stack in an inert gas atmosphere at a gas pressure between 200 and 2000 bar, for example between 400 and 2000 bar and at a treatment temperature (TB) corresponding to approximately 50 – 99% or 50 – 95% of the joining temperature (TF), i.e. the temperature at which all metal components of the system forming the joining connection have solidified.

5. Method according to one of the foregoing claims, characterized by post-treatment of the plate stack in an inert gas atmosphere at a gas pressure between 200 and 2000 bar, for example between 400 and 2000 bar and at a treatment temperature (TB) corresponding to approximately 50 – 99% or 50 – 95% of the joining temperature (TF), i.e. the temperature at which all components of the brazing metal forming the joining connection have solidified.

6. Method according to one of the foregoing claims, characterized in that a joining material (7) is applied at least to the surface sides of the plates to be joined.

7. Method according to one of the foregoing claims, characterized by the following process steps:
application of a brazing metal as joining material to the plates,
stacking of the plates to form the plate stack,
heating of the plate stack at least to the melting temperature of the brazing metal,
cooling of the plate stack to a temperature below the melting temperature of the brazing metal,
HIP post-treatment of the plate stack.

8. Method according to one of the foregoing claims, characterized in that during the HIP post-treatment an inert gas atmosphere, for example an inert gas atmosphere formed by argon or nitrogen with a maximum oxygen content is used that amounts to approximately 300% of the oxygen content corresponding to the equilibrium oxygen partial pressure at the treatment temperature (TB).

9. Method according to claim 8, characterized in that the oxygen content in

the inert gas atmosphere is less than an oxygen partial pressure of 15×10^{-6} bar.

10. Method according to one of the foregoing claims, characterized by the following process steps:
application or creation of a copper-oxide layer as joining material on the plates made of copper,
heating of the plates after stacking to a temperature between 1065 and 1083°C,
HIP post-treatment of the plate stack at a pressure between 200 and 2000 bar, for example between 400 and 2000 bar and at a post-treatment temperature of at least 390°C and no more than 1052°C.

11. Method according to one of the foregoing claims, characterized by the following process steps:
application or creation of a copper-oxide layer as joining material on the plates made of copper,
heating of the plates after stacking to a temperature of 1065°C and HIP post-treatment of the plate stack at a pressure of 1000 bar at a post-treatment temperature of 1020°C.

12. Method according to one of the foregoing claims, characterized in that the joining of the plates (1 – 5) takes place with the application of heat at a mechanic pressing force between 20 and 2500 bar.

13. Method according to one of the foregoing claims, characterized in that the plates are made of copper and that silver is used as the joining material, forming together with the adjoining copper a silver-copper alloy, that in order to join the plate stack, the stack is heated to a temperature between 778 and 990°C, and that the HIP post-treatment takes place at a pressure between

400 and 2000 bar at a post-treatment temperature of at least 252°C and no more than 767°C, for example at 650°C.

14. Method according to one of the foregoing claims, characterized in that the plates are made of copper, that silver is used as the joining material, forming together with the adjoining copper a silver-copper alloy, that in order to join the plate stack, the stack is heated to a temperature of 850°C, and that the HIP post-treatment takes place at a pressure 1200 bar at a post-treatment temperature of 650°C.

15. Method according to one of the foregoing claims, characterized by the following process steps:
use of plates made of copper and gold or a gold-copper alloy as the joining material,
heating of the plate stack to a temperature between 880 and 1065°C,
post-treatment of the plate stack at a temperature of at least 408°C and no more than 877°C.

16. Method according to one of the foregoing claims, characterized by the following process steps:
use of plates made of copper and gold or a gold-copper alloy as the joining material,
heating of the plate stack to a temperature of 1030°C,
HIP post-treatment of the plate stack at a temperature of 920°C and a pressure (PB) of 900 bar.

17. Method according to one of the foregoing claims, characterized in that at least one electric component is fastened to the plate stack or to the cooler (6, 6a) formed by the plate stack, for example by means of brazing, and the component is for example a laser diode or light-emitting diode.

18. Method according to one of the foregoing claims, characterized in that the joining material (7) is also applied to surfaces of at least some openings.

19. Method according to one of the foregoing claims, characterized in that the plate stack or the cooler (6, 6a) formed by said plate stack is processed on at least one surface by diamond cutting.